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(71) Applicant: **Johnson & Johnson Industrial Ltda.**
Sao Jose dos Campos, SP (BR)

(72) Inventors:
- **Pereira, Jose Antonio**
  Sao Jose dos Campos, SP (BR)
- **Micheletto, Maria Cristina Guedes Jorge**
  Sao Jose dos Campos, SP (BR)

(74) Representative: **Mercer, Christopher Paul et al**
Carpmaels & Ransford
43, Bloomsbury Square
London WC1A 2RA (GB)

(54) A cleansing tissue

(57) The present invention is related to a cleansing tissue, comprising a thermobonded non-woven fabric formed from a mixture of fibers containing greater than 75% of thermoplastic fibers, the non-woven fabric having a plurality of cells, each cell having a first density and a first volume, the cells being disposed adjacent to one another defining a region between adjacent cells, the region having a second density and a second volume, the second density being higher than the first density, and the second volume being less than the first volume.

The fabric becomes thicker and its softness is increased because the cells have a low density large sized regions.

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Description

[0001] The present invention is related to a cleansing tissue, especially a pre-wet cleansing tissue.

Background of the invention

[0002] Several fabrics are known in the state of the art to be applied for cleaning purposes, especially for cleaning parts of the human body. Generally, the fabrics used in the manufacture of cleaning products are manufactured by a process that does not involve any weaving operation, so such fabrics are called "non-woven" fabrics.

[0003] The non-woven fabrics need to have specific characteristics, mainly concerned with the softness and thickness, to suitably provide an efficient and pleasing cleanness.

[0004] To provide such characteristics, several manufacturing processes can be used, amongst which we have card and bind, thermobonding, spunbonding, meltblown, airlaid (air flow), spunlace (water jet) and hydrospun.

[0005] For the manufacture of cleansing tissues, such as wet cleansing tissues, a basic feature to be considered is the possibility of producing non-woven fabrics that are thick, soft and capable of absorbing liquids. it is noted that cellulose improves the absorption of liquids from fabrics.

[0006] Meltblown and spunlace processes provide non-woven structures having a sufficient thickness and softness, the latter (spunlace) also allowing the use of cellulose, which is known to provide higher mechanical strength and higher capacity to absorb liquids from fabrics. The great shortcoming these processes at present, however, is that they are extremely expensive, the consequence of which is that the final cost of the product increases significantly.

[0007] The processes known to involve low costs do not completely satisfy the required characteristics for cleansing tissues, since non-woven fabrics so produced have a structure substantially comprised of high density and low thickness regions, making them not desirable. Figure 1 illustrates a portion of a non-woven fabric 1 produced by a thermobonding process of the prior art, wherein small and low density regions 2 are disposed amongst high density regions 3. Consequently, the products obtained do not suitably have the combination of softness and liquid absorption.

[0008] An objective of the present invention is therefore to provide a cleansing tissue and the process for the manufacture thereof, having a low manufacture cost.

[0009] A second objective of the present invention is to provide a thick and soft cleansing tissue having both a high capacity of retaining fluid and a high wettability.

Summary of the invention

[0010] The objectives above are attained by means of a cleansing tissue, comprising a thermobonding non-woven fabric formed from a mixture of fibers containing at least 76% of thermoplastic fibers, the non-woven fabric having a plurality of cells, each cell having a first density and a first volume, the cells being disposed adjacent to one another defining a region between adjacent cells, the region having a second density and a second volume, the second density being higher than the first density, and the second volume being less than the first volume. In the preferred embodiments said non-woven fabric may comprise thermoplastic fibers or a mixture of thermoplastic fibers and cellulosic fibers.

Brief description of the drawings

[0011] The Figures are briefly described below:

Figure 1 is a view of the arrangement of known non-woven fabric cells.

Figure 2 is a view of the arrangement of the non-woven fabric cells of the present invention.

Detailed description of the invention

[0012] Figure 2 illustrates the embodiment of a cleansing tissue, specially a pre-wet cleansing tissue of the present invention. It can be seen that this non-woven fabric 4 comprises a plurality of cells 6 disposed adjacent to one another, uniformly at not, particularly in the form of a honeycomb. Adjacent cells 6 define a wall between them, forming a region 5 between cells, so that a wall is common to at least two adjacent cells 6. Alternatively, cells 6 can be provided with several forms, provided that defining walls between them. Each cell 6 have a first density and a first volume, and the region 5 between cells has a second density and a second volume. Due to the process of manufacturing this fabric, which will be disclosed below, the second density of the region 5 between cells is higher than the first density of the cells 6 and the second volume of the region 5 between cells is less than the first volume of the cells 6. In addition, the fact that cells 6 have large sized low density regions makes the fabric thicker, as well as intensifies its softness.

[0013] In the process of manufacturing this fabric, preferably polypropylene fibers and rayon fibers are homogene-

ously mixed in a mixing and blending chamber, and then formed into cards to compose a fibrous web. It should be noticed, however, that other thermoplastic fibers, or even a combination of thermoplastic fiber with cellulose fibers, could be used without departing from the scope of the present invention.

[0014] After the preparation of the fibrous screen, it is fed into a calendering station, which comprises at least two calendering rolls: a hot flat roll and a patterned embossing roll having protruding walls in a shape that will define the cells 6 to be formed. This patterned embossing roll deforms the fibrous web, fusing the thermoplastic fibers in the regions determined by the protruding walls (forming the region 5 between cells), reducing the thickness and consequently increasing the density in this region, forming a non-woven fabric composed of a plurality of cells uniformly disposed in the shape of a honeycomb, the cells 6 being determined by the fused region 5 between cells, as illustrated in figure 2. It should be noted that (i) the cells 6 have a higher thickness, since they are not formed by fused fibers and (ii) the shape of the cells is determined by the embossing of the roll. In other words, if, instead of having a hexagon-shaped embossing, the roll had a pentagon shaped embossing, for example, the cells 6 of the non-woven fabric would have such shapes.

[0015] The process for manufacturing cleansing tissue described above makes it possible to obtain a product different from the others obtained through thermobonding already known of the state of the art, in view of the fact that a very thick product can be obtained because it is basically composed of a low density cells.

[0016] The fact that the rayon textile fiber is present in the fibrous structure together with the thermoplastic fiber makes it possible to obtain an additional wettability due to the chemical absorbency of polar chemical groups of the regenerated cellulose, herein called rayon or viscose.

[0017] In an further embodiment of the present invention, the cleansing tissue of the present invention can also include opacifying agents or dyeing agents, such as TiO_2 or the like, providing an easy color pigmentation in the thermoplastic polypropylene fiber and an easy combination of colors during the process for the preparation of the fibrous web.

[0018] The process of the present invention also makes it possible to obtain a highly flexible fabric, since several fast adjustments in the control of the polymer mass addition, in the control of the fiber denier within a large range of deniers, and in the control of the fiber cut length within a large range of lengths can be made in the process for the preparation of the fibrous web, as well as the possibility of producing textile fibers having one or several denier with cut dimensions of one or several lengths. In addition, said flexibility also makes it possible to use a large variety of polypropylene and rayon textile fibers. More specifically, the present invention makes it possible to use several ranges of varying parameters, such as different fiber denier (the thickness unit for silk yarns and artificial fibers such as rayon and nylon, equal to the thickness of a yarn that weighs 0.05 g every 450 m of length or 1 g every 9,000 m), addition of fibers, fiber mixture, fiber size and several levels of basis weight of the thermobonded fabric. The web has a basis weight of 20 to 60 grams per square meter.

[0019] In the preferred embodiment of the present invention, a mixture containing greater than about 75% of the thermoplastic fibers is used, preferably a mixture of polypropylene fiber and rayon fiber at a 95%:5% to substantially 76:24% ratio, and more preferably at 90%:10% and 80%:20% ratios can be considered.

[0020] Preferably, the polypropylene fiber has a denier between 0.5 and 5.0 denier, more preferably in the 0.8 to 4.0 range, and still more preferably in the 1.3 to 1.5 range.

[0021] The rayon fiber can have the same denier range above, however the preferred value specifically ranges between 0.8 and 3.

[0022] Both rayon fibers and polypropylene fibers are processed in a 30 mm to 60 mm cut size range, and even a mixture of one or several sizes can be used in the present invention.

[0023] The thickness of the tissue subject of this invention varies preferably between 250 to 800 micrometers, and a comparison between already known thermobonded tissue and the present tissue is in the following table 1:

	Base weight (g/m^2)	Thickness (micrometers)
Known thermobonded tissue	20	200
	45	350
Tissue of present invention	20	280
	45	600

[0024] As can be seen in the table above, the thermobonded formed tissue object of this invention is at least 40% thicker than conventional thermobonded formed tissues. These comparison can be measured by a test procedure TN 253.

[0025] With respect to the TiO_2 content, it can be in the 0 to 3% range, and preferably in the 0,5 to 2% range for the

polypropylene fiber. In its turn, the rayon fiber has a 0% to 1,5% TiO_2 content as an opacifying agent.

[0026] In addition, colored fibers can be produced by using available standard industrial pigments available in polypropylene manufacturing plants.

[0027] In accordance with a preferred embodiment of the present invention. the polypropylene fiber is treated with a surface finishing surfactant in order to attain a suitable hydrophilic control of the thermobonded fabric.

[0028] The control of the surface energy in the polypropylene fibers range can be attained by applying the surfactant in the polypropylene weaving process (in 30 to 72 dyne/cm^2 range). The surface energy of the rayon fibers is approximately 72 dyne/cm^2, thus promoting the wettability in both types of related fibers and fabrics.

[0029] To better illustrate the advantages of the present invention, let us consider two areas of comparison, such as the areas shown in Figures 1 and 2.

[0030] The relief configurations of the two areas shown in Figures 1 and 2 follow the standard below:

Honeycomb configuration (figure 2) - approximately 6.25 cells/area;
Pointed configuration (figure 1) - approximately 30 points/area.

[0031] In Figure 1, the areas of the cells shown have the following values:

Area 1 - 37.6670
Area 2 - 35,6920
Area 3 - 37.4697
Area 4 - 34, 5172
Area 5 - 34.8073
Area 6 - 34, 1308
Area 7 - 35.7971
Area 8 - 45.4778
Area 9 - 31.4983
Area 10 - 37.2842
Area 11 - 38.1189
Area 12 - 38.5612
Area 13 - 34.5146
Area 14 - 29.0410
Area 15 - 31.3793
Area 16 - 39.4947
Area 17 - 35.7229
Area 18 - 42.9106
Area 19 - 35.3365
Area 20 - 23.2021
Area 21 - 37.5624
Area 22 - 40.9941
Area 23 - 15.4413
Area 24 - 31.7039
Area 25 - 31.9049
Area 26 - 35.9084
Area 27 - 35.9239
Area 28 - 14.9239
Area 29 - 10.2084
Area 30 - 8.8107

[0032] In Figure 2, the areas of the pointed relief shown have the following values:

Area 1 - 126.9520
Area 2 - 67.5332
Area 3 - 681.8963
Area 4 - 4.7257
Area 5 - 263.2115
Area 6 - 1121.0791
Area 7 - 241.0448
Area 8 - 1396, 5022

Area 9 - 222.6300
Area 10 - 171.7930
Area 11 - 896.0243
Area 12 - 11.8360

[0033] It can be seen that the area of each cell in the honoycomb is on the average 53% larger than the area of point relief.

[0034] Let us assume that the following comparative data are obtained, in which:

MD corresponds to a cut in the "machine direction"
CD corresponds to a cut in the transversal direction, and
45° corresponds to a cut in the 45° direction.

Table 2:

Comparative table between the honeycomb structure and the pointed structure					
	Linking		Surface Area		
	Standard	Percentage of linking area (fused area/total area)	MD	CD	45°
Fig. 1	Points	16%	597	410	392
Fig. 2	Walls	12%	773	752	598
Difference	Higher	4%	30%	80%	50%

[0035] From the data above, we can conclude as follows:

A - With respect to a low density cells (3- fig 1; 6 - fig. 2):
The honeycomb structure has 30/6.25 more a low density regions than the structure of the state of the art.
B - With respect to the area of a low density cells:

(1) The honeycomb structure has average that is 4% higher.
(2) The honeycomb structure is 4 to 5 times higher than the pointed pattern with respect to the amount of free fibers, due to the formation of cells in the fabric web.

[0036] By considering the fact that the same basis weight of the honeycomb and pointed structures has been maintained for the data above, as well as the same fiber compositions of the analyzed structures, we can get a estimate of the thickness increment by using a ratio between the following parameters:

Symbol	Property	Unit
Df	Cell fiber diameter	μm
D	Cell fiber denier	g/9,000 m
ρfiber	Cell fiber specific mass	g/cm^3
W	Fabric base weight	g/cm^2
θ	Fabric thickness	Mm
ρfabric	Fabric specific mass	g/cm^3
Vf	Void fraction	air/fiber

[0037] For similar fabric structures, the increment in the volume is related with the increment of the screen void fraction.

[0038] The void fraction of a fabric can be calculated by using the following equation.

$$Vf = 1 - 1.335 (W/\theta\rho fiber)$$

[0039] By calcutating Vf for the honeycomb and pointed structures in described, we have the following results:

Honeycomb - Vf = 13.3/1

Pointed - Vf = 7.6/1

[0040] The result of this relationship for the increment in the thickness is 13.3/7.6, that is, approximately 76% of the apparent additional volume of the fabric (in the honeycomb structure),when compared with the pointed, structure fabric.

[0041] Considering the results of items A and B above and considering the calculation the void fraction, the honeycomb structure presents a larger area of free surface fibers, as well as a higher volume of the screen due to the relief of the cells when compared with the standard pointed structure.

[0042] Also considering that the surface area and the apparent volume of the non-women structure is a function of the a low density cells, we can express the following relationship, which is related with the comparison of the pointed and honeycomb structures.

	Cell surface area	Cell volume
Pointed structure	1	1
Honeycomb structure	1.53	1.75

[0043] Thus, it can be seen that the honeycomb pattern of the present invention results in a free fiber cell with 53% more area and 75% more volume.

[0044] After having been described the examples of preferred embodiments, it should be understood that the scope of the present invention covers other possible variations, being limited only by the appended claims, wherein the possible equivalents are included.

Claims

1. A cleansing tissue, comprising a thermobonded non-woven fabric wherein the non-woven fabric is formed from a mixture of fibers containing greater than 75% thermoplastic fibers, the non-woven fabric having a plurality of cells, each cell having a first density and a first volume, the cell being disposed adjacent to one another defining a region between adjacent cells, the region having a second density and a second volume, the second density being higher than the first density, and the second volume being less than the first volume.

2. The tissue according to claim 1, wherein the cells have a uniform shape, preferably hexagonal.

3. The tissue according to claim 1, wherein the cells are arranged in a honeycomb pattern.

4. The tissue according to claim 1, wherein said non-woven fabric comprises a mixture of thermoplastic fibers and cellulose fibers.

5. The tissue according to claim 4, wherein said thermoplastic fibers are polypropylene fibers and said cellulose fibers are rayon fibers.

6. The tissue according to claim 5, wherein the mixture of polypropylene fibers and rayon fibers preferably has a ratio between, the 90%:10% and 80%:20%.

7. The tissue according to claim 5, wherein the polypropylene fiber has a denier index in the range between 0.5 and 5.0.

8. The tissue according to claim 7, wherein the polypropylene fiber has a denier between 0.5 and 4.0.

9. The tissue according to claim 7, wherein the polypropylene fiber has a denier between 0.8 and 1.5.

10. The tissue according to claim 5, wherein the rayon fiber preferably has a denier between 0.5 and 5.0.

11. The cleansing tissue according to claim 10, wherein the rayon fiber preferably has a denier between 0.8 and 3.

12. The tissue according to claim 5, wherein the polypropylene fibers and the rayon fibers have a cut size range between 30 mm and 60 mm.

13. The tissue according to claim 1, wherein its thickness varies between 250 to 800 micrometers.

14. The tissue according to claim 1, wherein said tissue also includes an opacifying agent

15. The tissue according to claim 14, wherein said opacifying agent is TiO_2.

16. The tissue according to claim 15, wherein the TiO_2 content in the polypropylene fiber is preferably up to 3%

17. The tissue according to claim 16, wherein the TiO_2 content in the polypropylene fiber is from 0.5 to 2%.

18. The tissue according to claim 17, wherein the TiO_2 content in the rayon fiber is preferably from 0.5 to 1.5%.

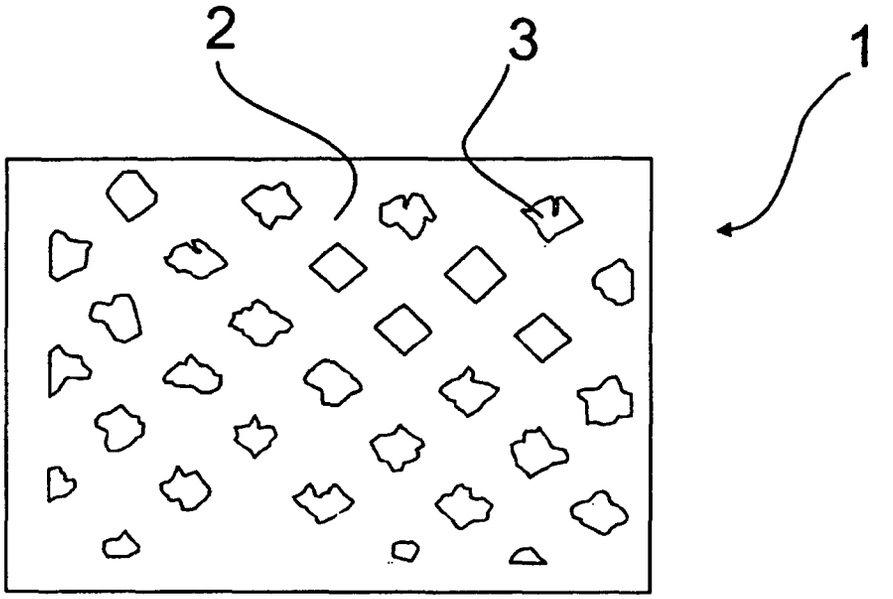

Fig 1

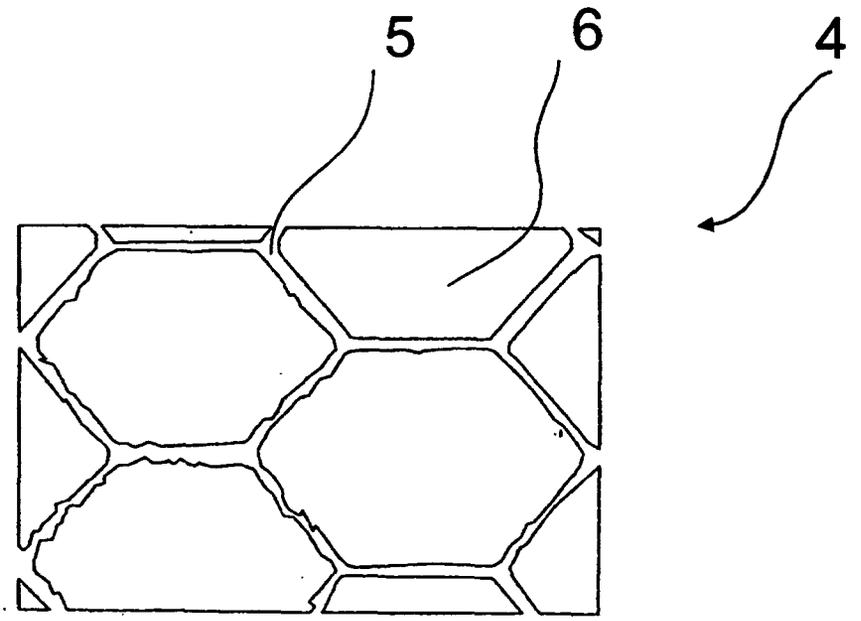

Fig 2